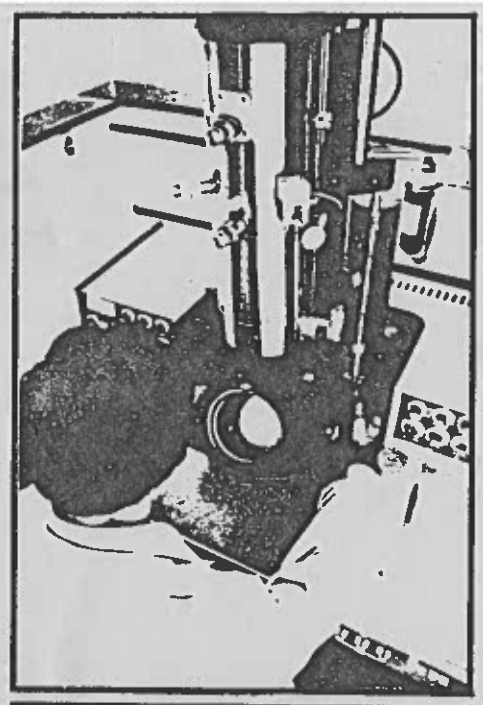
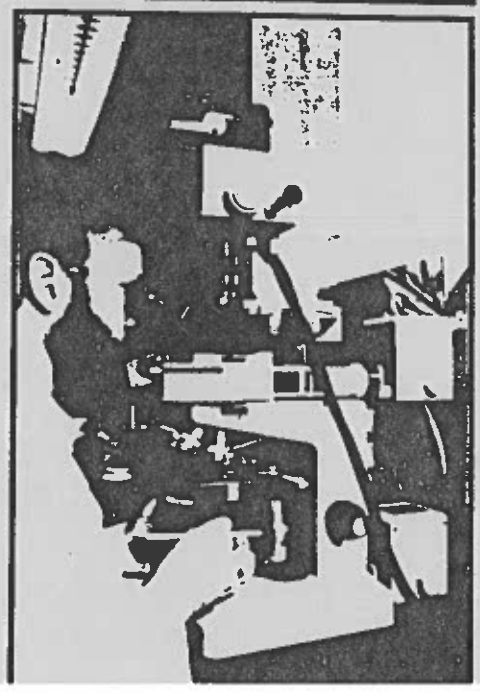




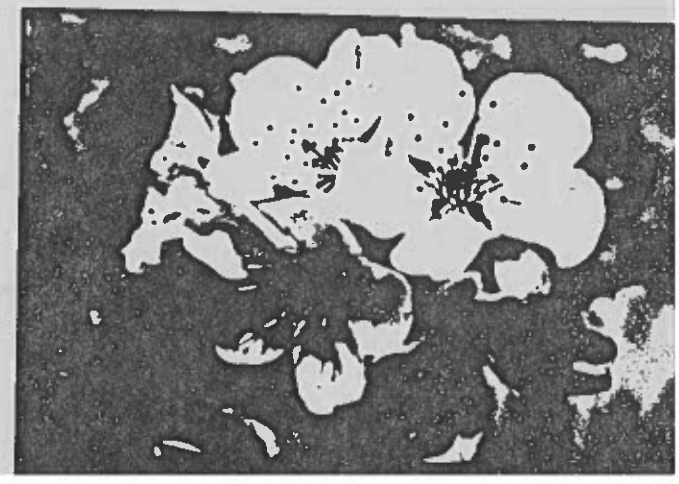
20TH PLANT DEVELOPMENT WORKSHOP

SATURDAY, NOVEMBER 7, 1987

VINELAND, ONTARIO

Agriculture Canada

Ministry of Agriculture and Food
ONTARIO



TWENTIETH PLANT DEVELOPMENT WORKSHOP

Saturday, November 7, 1987

Agriculture Canada - Horticultural Research Institute of Ontario

Vineland Station, Ontario

WORKSHOP PROGRAM:

9:00 - 9:20 a.m. - Registration

9:20 a.m. - Introductory Remarks

9:30 a.m. - Phytin biosynthesis is promoted by exogenous phosphate in germinated castor bean cotyledons. M.G. Organ, J.S. Greenwood, and J.D. Bewley, Dept. of Botany, University of Guelph.

9:45 a.m. - Identification of self-incompatibility - associated proteins in red clover. P.A. Eastman and B.E. Ellis, Dept. of Chemistry and Biochemistry, University of Guelph.

10:00 a.m. - Microtubule assembly sites in higher plant cells following depolymerization by APM. R.W. Seagull and M.M. Falconer, Dept. of Biology, Carleton University.

10:15 a.m. - Transfer of cytoplasmic traits in canola by protoplast fusion. S.A. Yarrow, R.J. Kemble, and T.L. Barsby, Allelix Inc., Mississauga, Ontario.

10:30 a.m. - Occurrence of a new virus infecting Arctium minus. L.W. Stobbs, Agriculture Canada, Vineland Station.

10:45 a.m. - A new berberene-aniline blue staining procedure for plant tissue. M.C. Brundrett, C.A. Peterson, and D.E. Enstone, Dept. of Biology, University of Waterloo.

11:00 a.m. - BREAK

11:15 a.m. - Suberin formation in noninoculated wounds and its association with susceptibility to peach canker disease in various peach cultivars. A.R. Biggs and N.W. Miles, Agriculture Canada and Horticultural Research Institute of Ontario, respectively, Vineland Station.

WORKSHOP PROGRAM cont'd.

11:30 a.m. - The effects of drought on the roots of two species possessing an exodermis. E. Stasovski and C.A. Peterson, Dept. of Biology, University of Waterloo.

11:45 a.m. - Mycorrhizae in a hardwood forest, M. Brundrett and B. Kendrick, Dept. of Biology, University of Waterloo.

12:00 noon - Incidence and distribution of elm yellows in Ontario. J.A. Matteoni, Agriculture Canada, Vineland Station.

12:15 p.m. - Does gravity regulate leaf placement in Corylus? A.D. MacDonald, P. Christie, and L. Tarnowski. Dept. of Biology, Lakehead University.

12:30- 1:30 p.m. - BREAK FOR CATERED LUNCH AND VIEW POSTERS

1:30 p.m. - The influence of short photoperiod upon low temperature growth and freezing resistance in winter rye. M. Griffith, Dept. of Biology, University of Waterloo.

1:45 p.m. - Thorn ontogeny and structure in the tropical liane Artabotrys hexaptalus (Annonaceae). U. Posluszny and J.B. Fisher. Dept. of Botany, University of Guelph and Fairchild Tropical Garden, Miami, Florida, respectively.

2:00 p.m. - Plasticity in leaf development in the Vitaceae. C. LaCroix and U. Posluszny, Dept. of Botany, University of Guelph.

2:15 p.m. - Control of bunch rot in grapes with plant growth regulators. J. Northover, Agriculture Canada, Vineland Station.

2:30 p.m. - Initiation and development of lateral roots in Typha glauca. J.L. Seago and L.C. Marsh. SUNY, College at Oswego, New York.

2:45 p.m. - Pinus banksiana Lamb.: The archegonium from inception in the female gametophyte to fertilization. M.I. Moore, Deep River, Ont.

3:00 p.m. - BREAK

3:15 - 4:15 p.m. - Tour of facilities

4:15 - 6:00 p.m. - Tour of Paul Masson Winery

PHYTIN BIOSYNTHESIS IS PROMOTED BY EXOGENOUS PHOSPHATE IN GERMINATED CASTOR BEAN COTYLEDONS

M.G. Organ, J.S. Greenwood and J.D. Bewley, Botany Dept., University of Guelph, Guelph, Ontario, Canada, N1G 2W1

The metabolism of the seed's major phosphate storage compound, phytic acid, was followed using imbibed, germinated seeds of castor bean (Ricinus communis). Phytic acid content in the endosperm declined continually following imbibition, whereas levels in the embryo declined over the first 48 h following imbibition then increased significantly after this period. This supports an earlier report by Dmitrieva and Sobolev (1984) that embryos in intact, germinated castor bean seeds are capable of synthesizing phytic acid. We have found that isolated embryos maintain this capacity when optimal levels of phosphate (10 mM) and a suitable carbon source (sucrose or inositol) are provided. Cotyledons or intact embryos isolated 48 h following imbibition, when embryo phytic acid levels are low, similarly maintain the capacity for synthesizing phytic acid. The ability to experimentally manipulate the synthesis of phytic acid in isolated, germinated castor bean embryos provides an excellent model system for studying mechanism of control and enzymes involved in the synthesis of this compound in seeds.

IDENTIFICATION OF SELF-INCOMPATABILITY-ASSOCIATED PROTEINS IN RED CLOVER

P. A. Eastman and B. E. Ellis, Department of Chemistry and Biochemistry, University of Guelph, Guelph, Ontario

Self-fertilization in red clover, Trifolium pratense L., is prevented by a gametophytic self-incompatibility (SI) system governed by a single Mendelian gene called the S-locus. To isolate SI proteins, style extracts from four near-isogenic lines of red clover homozygous for different S-alleles, and several heterozygous crosses have been analyzed by SDS-PAGE, isoelectric focusing and chromatofocusing. At present, three proteins segregating with three different S-alleles have been tentatively identified. Purification of the S1-allele-associated protein for physical characterization and for use in a bioassay, is in progress.

Transfer of Cytoplasmic Traits in Canola by Protoplast Fusion.

S.A. YARROW, R.J. KEMBLE, and T.L. BARSBY

Allelix Inc., 6850 Goreway Drive, Mississauga, Ontario, L4V 1P1, Canada.

Novel cell and molecular technologies are useful as plant breeding aids as they allow the creation of products which are unattainable by conventional methods, and the completion of desired goals more rapidly or at reduced cost. Protoplast fusion has taken its place alongside anther and microspore culture in reducing the length of breeding cycles and in expanding the available germplasm. The best examples of this can be found in canola (oil-seed rape). We have produced 45 cytoplasmic hybrids including both spring and winter genotypes of Brassica napus, separately transferring "polima", "ogu" and "nap" type mitochondrial encoded cytoplasmic male sterility, and chloroplast encoded triazine resistance into different nuclear backgrounds. Many of these 'cybrid' lines have been incorporated into field trials. This research will impact on conventional breeding for the further improvement of this important crop.

THE EFFECT OF LONG TERM STORAGE OF FROZEN VIRUS-INFECTED FOLIAR TISSUES ON VIRUS DETECTION BY ELISA. D. Barker[1] and L.W. Stobbs[2]
1. Graduate research assistant, Dept. Biology, University of Waterloo
2. Research Scientist, Agriculture Canada, Vineland Research Station

Long term storage of frozen virus-infected, intact leaves of Chenopodium quinoa and Vitis vinifera cv. Chardonnay resulted in a rapid decline in ELISA absorbance values. When virus-infected leaves were triturated in ELISA extraction buffer ammended with 1% nicotinic acid and frozen, viral antigenicity was maintained for significantly longer periods. Repetitive freeze-thaw cycles of buffered leaf triturates resulted in a gradual drop in antigenicity. The significance of these findings will be discussed.

USE OF WOUND RESPONSE PARAMETERS TO ASSESS THE RELATIVE SUSCEPTIBILITY OF PEACH CULTIVARS TO LEUCOSTOMA SPP. A.R. Biggs. Agriculture Canada, Research Station, Vineland Station, Ontario, Canada, LOR 2EO.

Twigs of ten field-grown peach clones were wounded and sampled for histological study after 0, 3, 7, 10, 14, and 17 days. Counts of cells and tissue thickness measurements were used to determine the extent of formation of lignosuberized boundary tissue and suberized wound periderm. Also, suberin autofluorescence intensity was measured using a microscope photometer. The experiment was conducted at one location in 1985 and two in 1986. Experiments were conducted in April, May, June, July, September, October and November in randomized complete block plantings at both sites. There were no consistent relationships between relative susceptibility to disease and cell number or tissue thickness. The rate of increase in suberin autofluorescence intensity during May and June was significantly correlated in both years with the relative susceptibility of the cultivars to the peach canker fungi.

THE EFFECTS OF DROUGHT ON THE ROOTS OF TWO SPECIES POSSESSING AN EXODERMIS. Elida Stasovski and Carol A. Peterson, Department of Biology, University of Waterloo, Waterloo, Ontario.

Experiments were done to simulate the natural desiccation and rehydration of roots. Symplastic tracer dyes were used to follow permeability changes in roots possessing an exodermis, the purpose being to determine the role of this layer during prolonged drought. Results of experiments with corn and onion indicate that these species have adopted two different strategies for coping with drought. Corn, an annual monocot, develops a very extensive root system. However, the epidermal and cortical layers of older regions of the roots die while the apices and young regions are maintained. Onion, a perennial monocot, develops many adventitious roots but relatively fewer laterals. The root apices are not as hardy as those of corn. Death of the apices is followed by lateral root initiation. However, a mechanism exists which senses an unfavourable environment and the lateral root primordia do not emerge but remain harboured by the main roots until conditions improve. Even after epidermal death, symplastic uptake by the short (passage) cells of the exodermis allows each adventitious root to remain absorptive along its whole length. In both these species, established and potential meristems are maintained so that the root systems can recover quickly upon rehydration.

MYCORRHIZAE IN A HARDWOOD FOREST

Mark Brundrett and Bryce Kendrick, Biology, U. of Waterloo.

Roots of vascular plant species occurring in a hardwood forest site dominated by sugar maple were examined for vesicular-arbuscular mycorrhizae (VAM). The majority of plants (71%) were associated with VAM, although some herbaceous plants were non-mycorrhizal (13%), facultatively mycorrhizal (9%), or had orchid mycorrhizae (3%), and several trees were ectomycorrhizal (4%). The herbaceous plants could be divided into 4 phenological categories (spring, spring-summer, summer, and fall) based on aboveground activity. Root activity did not parallel shoot activity in many species, and probably was a factor influencing mycorrhizal dependency. Protective root modifications, notably a well developed exodermis, were prominent features of the roots of most highly mycorrhizal species. These modifications, along with the long-lived, inextensive nature of the roots of most woodland plants, should greatly limit their nutrient absorption. These and other factors contributing to the dependency of most woodland plants on VAM are considered along with reasons for the low levels of, or absence of, mycorrhizal colonization in others.

ELM YELLOWS IN THE NIAGARA PENINSULA. J.A. Matteoni[1] and W.A. Sinclair[2]
1. Agriculture Canada, Research Station, Vineland Station, Ontario L0R 2E0.
2. Cornell University, Ithaca, New York, U.S.A. 14853-0331

In 1984 and 1985 Elm yellows (= elm phloem necrosis) was found in the northeastern Niagara peninsula in Ontario, and in 1984 as far west as Grimsby. Of the elm species native to Canada, *Ulmus americana* (American elm) and *U. rubra* (slippery elm) were affected. Elm yellows was identified on the bases of foliar symptoms, phloem discoloration, and presence of mycoplasmalike organisms in the sieve tube elements of affected trees. Bark patch-graft transmission was successful to five of seven *U. americana* in the field.

MACDONALD, A.D., P. CHRISTIE AND L. TARNOWSKY.

DOES GRAVITY REGULATE LEAF PLACEMENT IN CORYLUS?

DEPT. OF BIOLOGY, LAKEHEAD UNIVERSITY, THUNDER BAY, ONTARIO P7B 5E1. During the course of a broader study of vegetative and reproductive development in Corylus we observed consistent but unusual patterns of phyllotaxy and stipule arrangement in dissected buds. Phyllotaxy did not conform to traditional patterns; rather leaves were arranged in two ranks on the anterior (dorsal) side of a bud and the smaller stipules of the pairs were also positioned dorsally. An analysis of divergence angles led to a number of hypotheses, the most satisfactory prediction being that the divergence angle varies with the angle of shoot extension relative to gravity; 45° plagiotropic shoots had leaf divergence angles intermediate between orthotropic and 90° plagiotropic shoots. The branching pattern and distribution of male and female inflorescences are discussed in the context of optimizing leaf display in the various forms of the shrubby habit.

THE INFLUENCE OF SHORT PHOTOPERIOD UPON LOW TEMPERATURE GROWTH AND FREEZING RESISTANCE IN WINTER RYE.

Marilyn Griffith, Department of Biology, University of Waterloo, Waterloo, Ontario N2L 3G1

Winter rye plants were grown under four environmental regimes: 20°C/16 hr day; 5°C/16 hr day; 20°C/8 hr day; and 5°C/8 hr day. The growth and freezing resistance of both shoots and roots were measured. Rye plants grown at 20°C/16 hr accumulated dry weight and produced tillers, leaves, and roots faster than all other treatments. Reducing daylength or decreasing growth temperature resulted in lengthening of the lag phase of growth, as well as slowing the rate of initiation of tillers, leaves, and roots, and the rate of accumulation of dry weight. Both plant height and root length were reduced at 5°C, suggesting that cold temperature acts to restrict leaf and root elongation. The root tips of winter rye did not tolerate freezing temperatures lower than -8°C, and the maximum freezing resistance of the roots was not correlated with that of the leaves. Rye leaves were ranked from most to least freezing resistant as follows: 5°C/8 hr > 5°C/16 hr > 20°C/8 hr > 20°C/16 hr. Leaves grown at 5°C/8 hr tolerated temperatures as low as -33°C at one stage in plant development. It is possible, therefore, to obtain leaves with different degrees of freezing tolerance by manipulating growth temperature, photoperiod, and stage of plant development.

POSLUSZNY, USHER* and JACK B. FISHER. Department of Botany, University of Guelph, Ontario N1G 2W1, and Fairchild Tropical Garden, Miami, FL 33156.
-- Thorn ontogeny and structure in the tropical liane Artabotrys hexaptalus (Annonaceae).

A. hexapetalus is a tropical liane with a monopodial orthotropic trunk and lateral branches which can be either sylleptic-plagiotropic thorns (usually 2 per node) or prolleptic-plagiotropic, sympodial shoots with hooks which may terminate in solitary flowers. Some of the prolleptic laterals may become orthotropic and reiterate the leader axis. A developmental study was undertaken in order to determine if the double lateral thorns are derived from an ontogenetic, tangential displacement of initial serial buds. As well, we looked at the developmental relationship between sylleptic thorns and prolleptic, sympodial branches.

LACROIX, CHRISTIAN* and USHER POSLUSZNY. Department of Botany, University of Guelph, Guelph, Ontario N1G 2W1

Plasticity in leaf development in the Vitaceae

The Vitaceae is an interesting family morphologically. Its shoot morphology has generated various developmental and evolutionary interpretations. The development of Vitaceae leaves and structures associated with them, such as stipules also raises some interesting questions:

-How can stipules be interpreted developmentally?

-Are there any similarities between stipules and leaf lobes developmentally?

-Can small changes at the initiation level in leaf development account for the major differences observed in the shape of mature leaves?

In view of these questions, preliminary observations on developing leaves in selected members of the Vitaceae are discussed in terms of growth processes and possible methods of analysis are proposed to gain a better understanding of the morphogenetic activity taking place in young leaf primordia.

NORTHOVER, JOHN. Agriculture Canada, Research Station, Vineland Station, Ontario L0R 2E0.
-- Control of bunch rot in grapes with plant growth regulators.

The prebloom application of gibberellic acid (GA_3) to Seyval Blanc grapevines increased bunch length and reduced bunch tightness with no adverse effect on berry set nor on bunch weight. The more open bunches were less prone to spoilage from sour rot and from Botrytis bunch rot. On the tight-bunch cultivar Johannisberg Riesling, GA_3 increased bunch length, but reduced berry set and bunch weight. Furthermore, J. Riesling vines treated in 1983 showed delayed shoot development and severely reduced fruitfulness in 1984. Pinot noir and Chardonnay were insensitive to GA_3.

Seago, James L.*, Jr., and Leland C. Marsh. SUNY, College at Oswego, New York, U. S. A. Initiation and development of lateral roots in Typha glauca.

The main body of lateral roots of Typha glauca arises from the pericycle of the parent adventitious root. The rootcap of the lateral root normally derives from the parent endodermis, and the vascular connection between adventitious root and lateral root is formed by derivatives of parent root procambium or stelar parenchyma. A typical monocotyledonous three-tiered apical organization is achieved in the lateral root prior to its emergence from the parent adventitious root, and a small zone of crystalliferous cells begins maturation in the ground meristem prior to emergence. After emergence, a small air space system develops, as the root expands slightly and rootcap columella cells store small amounts of starch. During 1-2.5 cm elongation, the meristem narrows, crystal formation ceases, and stored rootcap starch disappears; the root stops elongating. Lateral roots of T. glauca are smaller than their parental adventitious roots; they normally have only two or three poles of xylem and phloem, and the cortex is less than six cells across.

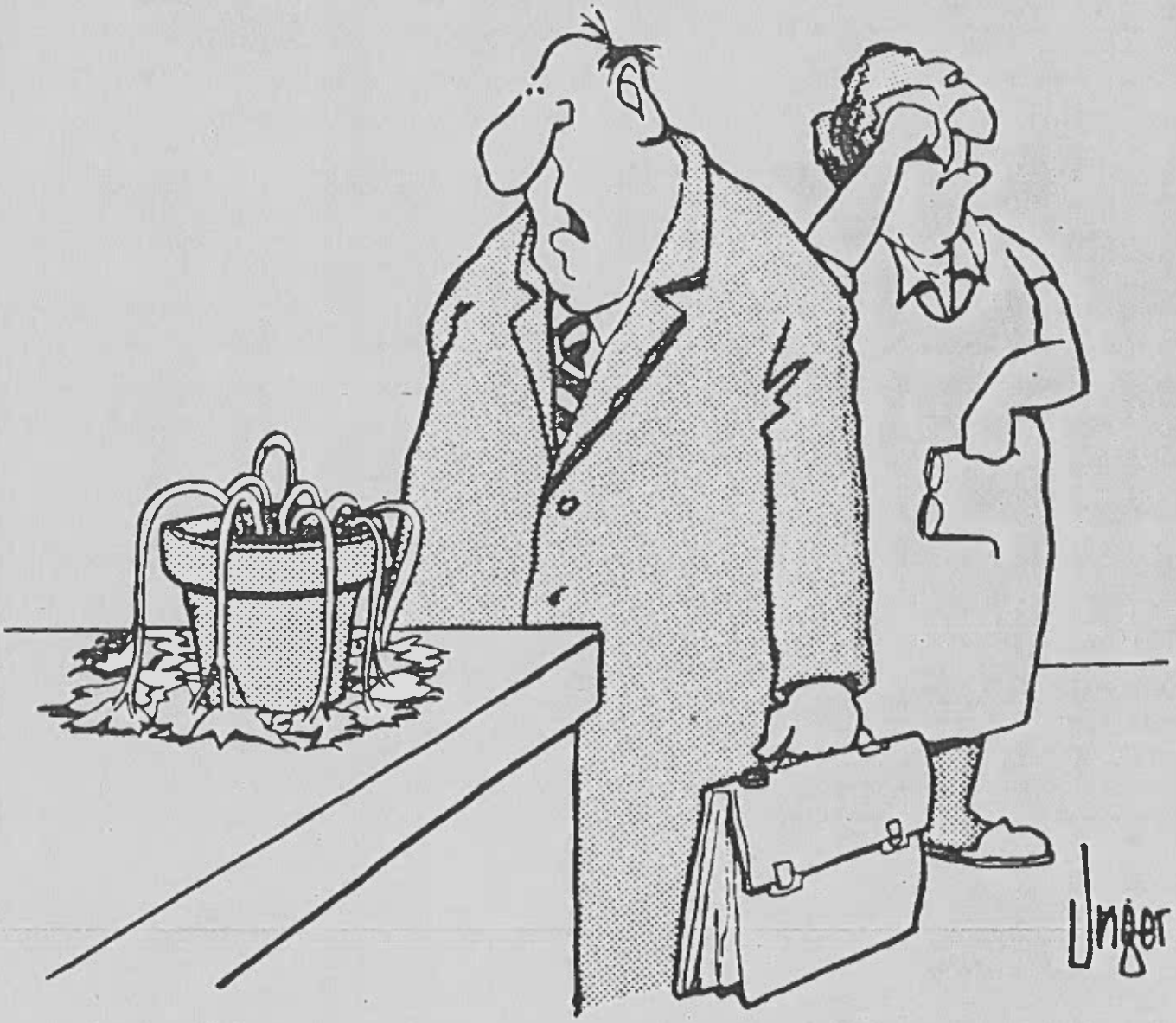
PINUS BANKSIANA Lamb.: THE ARCHEGONIUM FROM INCEPTION IN THE FEMALE GAMETOPHYTE TO FERTILIZATION. Mary I. Moore, 6 Laurier Avenue, Box 159, Deep River, Ontario. KOJ IPO

Formation of the archegonium or egg cell, its wall, the neck cells and the layer of jacket cells will be described as well as changes that occur as the archegonium becomes mature. Immediately before fertilization much of the egg cytoplasm is in large, multi-membraned compartments and the nucleus divides to form a ventral canal cell and the egg nucleus. As pollen tube contents are released into the archegonium and the sperm nucleus partly enters the egg nucleus, staining becomes difficult but chromatin can be detected. Nuclear membranes are still persistent at the point of junction as various inclusions, including male plastids with starch, appear in the egg cytoplasm.

A NEW BERBERINE-ANILINE BLUE STAINING PROCEDURE FOR PLANT TISSUE

Mark C. Brundrett, Carol A. Peterson, and Daryl E. Enstone.
Department of Biology, University of Waterloo, Ontario.

We have developed a fluorescent staining procedure that is particularly suited for detecting walls containing suberin, lignin and callose. Hand sections are stained with the fluorochrome berberine sulfate, counterstained with aniline blue and mounted in ferric chloride-glycerine. Suberin and lignin are intensely stained by berberine. The aniline blue blocks background fluorescence and illuminates the callose in the phloem. Under ultraviolet excitation, the yellow fluorescence of the endodermal and exodermal casparian bands contrast strongly with surrounding cell walls. This procedure is a sensitive and efficient method for examining wall modifications in plants.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